PATENT ABSTRACTS OF JAPAN

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(21)Application number : 10-348938 (71)Applicant : HITACHI LTD

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(54) NON-CONTACT IC CARD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a non-contact IC card which can receive and process signals modulated by the system based on either the ISO14443-A standard or ISO14443-B standard, and a semiconductor integrated circuit for realizing the card. SOLUTION: A non-contact IC card is provided with a first demodulation circuit 51 which reproduces data from 100% type-A (ISO14443-A) ASK signals with respect to the signals received through a coil, a second demodulation circuit 52 which reproduces data of 10% type-B (ISO14443-B) ASK signals from the signals received through the coil, and a selector circuit 54 which selects the reproduced signals. The card is also provided with a control circuit 53 which generates selection control signals.

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CLAIMS

[Claim(s)]

[Claim 1] The electromagnetic-coupling means for transmitting and receiving an AC signal, and a power-source means to connect with this electromagnetic-coupling means, to rectify an AC signal, and to generate a desired DC-power-supply electrical potential difference, The read/write control means which carries out read/write of the data between nonvolatile memory and this memory, At least two kinds of recovery means (the 1st recovery means for connecting with the above-mentioned electromagnetic-coupling means, and extracting received data from a receiving AC signal, and the 2nd recovery means), the modulation means for transmitting data, and the above -- with the selector means for choosing the output of two kinds of recovery means, even if few Have a control means for controlling this selector, and the above-mentioned selector means is controlled based on the recovery signal of both the recovery means of the above 1st and the 2nd recovery means, or one of the

two. The noncontact IC card characterized by operating so that the output of the recovery means of either the recovery means of the above 1st or the 2nd recovery means may be chosen.

[Claim 2] It is the noncontact IC card according to claim 1 characterized by being a circuit for the recovery means of the above 1st being a circuit for restoring to an ASK modulation (amplitude modulation) signal 100%, and for the 2nd recovery means restoring to an ASK modulating signal 10%.

[Claim 3] The recovery means of the above 1st is a noncontact IC card according to claim 2 characterized by generating a clock signal based on the output of the above-mentioned binarization circuit at the time of reception [which / of 100%ASK modulating signal or 10%ASK modulating signal] including the binarization circuit which carries out binarization of the input signal.

[Claim 4] The read/write control means which carries out read/write of the data between the above-mentioned nonvolatile memory and this memory is a noncontact IC card according to claim 1 characterized by being constituted by the semiconductor-integrated-circuit-ized one-chip microcomputer.

[Claim 5] The above-mentioned one-chip microcomputer is a noncontact IC card according to claim 4 characterized by being constituted by the circuit of a static logic method.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is used for the circuit built in the noncontact IC card which can respond to transmission and reception of the data based on two or more kinds of communication modes especially by the non-contact method with respect to the circuit constituted from a semiconductor integrated circuit chip built in an IC card by the IC card pan, and relates to a suitable technique.

[0002]

[Description of the Prior Art] In recent years, the IC card which contained ICs, such as CPU (microprocessor), attracts attention as an information storage medium which replaces a magnetic card. To an IC card, the coil by the side of an IC card receives the electric wave (an electromagnetic wave) generated from the IC card of a contact method which receives power and a clock signal, and an information signal from reader writer equipment using a contact, and processes a command with the transmission system of a signal, and the coil of reader writer equipment, power and a clock, and a transceiver signal generate to it, and there are two methods of the IC card

(henceforth a noncontact IC card) of a non-contact method which processes the command received from reader writer equipment in it.

[0003] Among these, the ISO standard is enacted by the communication range and the communication link frequency, and a noncontact IC card has two kinds, an adhesion mold (ISO10536) and a contiguity mold (ISO14443). Data "1" are expressed with the condition that a carrier signal with a frequency of 13.56MHz furthermore exists in a contiguity mold noncontact IC card by the modulation technique of data. ISO14443-A which has adopted the ASK modulation (ASK: amplitude modulation) method 100% which expresses data "0" with the condition that there is no carrier signal, There are two kinds of ISO14443-B which has adopted 10%ASK modulation technique which expresses data "0" with the signal of 90% of amplitude to the carrier signal showing data "1" of the amplitude.

[0004] An ISO14443-A modulation technique is a method used for a noncontact IC card with the control circuit which consisted of hardware logic which generally does not have CPU, and, generally ISO14443-A is used for an ID card (identification card), a PURIPEDO card, etc. as an object for IC cards with a simple protocol in many cases. On the other hand, an ISO14443-B type is a method used with the noncontact IC card which contained CPU, and ISO14443-B is used for an ATM card, a credit card, etc. with complicated protocols (for example, ISO7816-T1 etc.) for banks in many cases.

[0005] Moreover, the so-called combination card which unified the card of various specifications is proposed with the spread of noncontact IC cards in recent years.

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[Problem(s) to be Solved by the Invention] As a combination card, although the combination of current of a contact smart card and a noncontact IC card is in use, the appearance of the combination card which unified the IC card various type can be considered from now on.

[0007] this invention persons examined how to constitute the combination card which unified the ISO14443-A type and the ISO14443-B type.

[0008] As mentioned above, as a modulation technique of the data from a reader writer to a card, ISO14443-A uses an ASK modulation technique 100%, and ISO14443-B is using the ASK modulation technique 10%.

[0009] In order to receive both signals with which modulation techniques differ as a technical problem for realizing the two above-mentioned kinds of modulation techniques on the IC card of one sheet, it cannot be overemphasized that each demodulator circuit is the need, but in IC card system which shares and uses memory, if it does not identify which modulating signal was received, there is a problem that where of neither actuation of a consecutive memory read/write control circuit nor actuation of a microcomputer can be performed.

[0010] Therefore, when a card is inserted in a reader writer, it is necessary to identify of which modulation technique the signal was received, and it is necessary to control

actuation of a consecutive control circuit, for example, the read/write control circuit of EEPROM, and a microcomputer.

[0011] It is in offering the circuit built in the noncontact IC card and it which can carry out reception also by the signal modulated by the method of which specification of the purpose of this invention, ISO14443-A, and ISO14443-B.

[0012] It will become clear [about the other purposes and the new description] from description and the accompanying drawing of this specification along [said] this invention.

[0013]

[Means for Solving the Problem] It will be as follows if the outline of a typical thing is explained among invention indicated in this application.

[0014] In order to solve said technical problem, this invention establishes the 1st recovery means which reproduces data from an ASK signal type A(ISO14443-A) 100% about the signal received with the coil as an electromagnetic-coupling means, the 2nd recovery means which reproduces the data of an ASK signal type B(ISO14443-B) 10% from the signal received with the coil, and the selector means for choosing each regenerative signal. Moreover, in order to control this selector means, the control means for generating a selection-control signal is established by considering the 1st regenerative signal and sending signal of a recovery means as an input. And it constitutes so that either the regenerative signal (input signal from a reader writer to a card) of the 1st recovery means or the regenerative signal of the 2nd recovery means may be chosen with the above-mentioned selector means. Moreover, after it, when the selector means was controlled by the control means, the regenerative signal of the 2nd recovery means (or 1st recovery means) was usually chosen and the 1st recovery means detected playback data, it constituted so that the regenerative signal of the 1st recovery means (or 2nd recovery means) might be chosen.

[0015] Furthermore, the above-mentioned control means will control a selector means to choose the regenerative signal of the 2nd recovery means (or 1st recovery means), if the sending signal from a card to a reader writer occurs. And according to the input signal chosen as mentioned above, the read/write control means was made to perform a lead and light of data to nonvolatile memory, such as EEPROM.

[0016] According to the above-mentioned means, the circuit built in the noncontact IC card or it which can carry out reception also of which of ISO14443-A and ISO14443-B is realizable.

[0017] Moreover, it was made for the recovery means of the above 1st to make a clock signal generate based on the output of the above-mentioned binarization circuit including the binarization circuit which carries out binarization of the input signal at the time of reception [which / of 100%ASK modulating signal or 10%ASK modulating signal]. The circuit which reproduces a clock from an ASK modulating signal or 10%ASK modulating signal 100% can be shared by this, a clock generation circuit

becomes unnecessary at the 2nd recovery means, and simplification of a circuit is attained.

[0018] Furthermore, the above-mentioned read/write control means and nonvolatile memory are constituted from an one-chip microcomputer (LSI) etc., and you may make it control using software. And it is desirable to use what was constituted from a circuit of the static logic method instead of the dynamic logic method which the one-chip microcomputer precharges the predetermined node in a circuit beforehand, decides the potential of a node with an input signal, and opts for fanout which passes a current on the current pass according to an input signal, and determines fanout as it in this case. Since the clock signal reproduced from an input signal may be interrupted when Type A (ISO14443-A), i.e., the signal of 100%ASK modulation technique, is received, when the circuit of a dynamic logic method is used, it is because there is a possibility that actuation may not be guaranteed.

[0019]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail.

The block diagram, drawing 1 , and drawing 2 which show the 1st example of the circuit with a built-in noncontact IC card which <example 1 of operation gestalt> drawing 4 requires for this invention are drawing showing the configuration of the IC card which used the circuit with a built-in noncontact IC card of this invention.

[0020] It is carried or built and the circuit 1 with a built-in noncontact IC card as shown in drawing 1 , and the coil 2 as an electromagnetic-coupling means become the card with which the IC card of this example consists of insulating substrates, such as plastics or a ceramic. Although especially the coil 2 is not restricted, as shown in drawing 2 , it is constituted by the printed circuit formed on the substrate 10 at the curled form. Although especially the circuit 1 with a built-in card is not restricted, it is constituted as a semiconductor integrated circuit on one semi-conductor substrate like a single crystal silicon chip.

[0021] The conventional general circuit 1 with a built-in noncontact IC card The rectifier circuit 3 which is connected to a coil 2, rectifies a receiving AC signal, and is changed into direct current voltage as shown in drawing 3 , The power circuit 4 which generates the supply voltage VDD required for the drive of the circuit in IC based on the direct current voltage changed by this rectifier circuit 3, The demodulator circuit 5 which extracts receipt information contained in the AC signal supplied from the outside through the above-mentioned coil 2 (recovery), The modulation circuit 6 which forms the AC signal containing transmit information (modulation), and drives the above-mentioned coil 2, The nonvolatile memory 8 in which write-in elimination on an electric target like EEPROM is possible, By said demodulator circuit 5 Protocol control of transmission and reception between external reader writers in the processing list of outputting the transmit information which wrote in data or was read

from nonvolatile memory 8 into said nonvolatile memory 8 based on the receipt information to which it restored to said modulation circuit 6 It is constituted by the read/write control circuit 7 to perform.

[0022] The AC signal received with the above-mentioned coil 2 is inputted into a demodulator circuit 5, recovers this from the signal by which the ASK modulation (amplitude modulation) was carried out, and reproduces a data signal. The reproduced data are written in the EEPROM memory circuit 8 by the read/write control circuit 7 which performs transceiver protocol control in the read/write control list of memory. On the other hand, the transmit data from a card to a reader writer is read from a memory circuit 8 by the read/write control circuit 7, by the modulation circuit 6, performs LSK (load modulation) to a coil signal, and transmits data.

[0023] As shown in drawing 4 , in the 1st example of this invention a demodulator circuit It consists of the 2nd demodulator circuit 52 for reproducing 10%ASK signal of the 1st demodulator circuit 51 for reproducing 100%ASK signal of ISO14443-A from the signal received with the coil 2, and ISO14443-B. Either is chosen by the selector circuit 54 and the signal to which it restored by the 1st demodulator circuit 51 or 2nd demodulator circuit 52 is inputted into the read/write control circuit 7. Said selector circuit 54 is controlled by the control circuit 53. If the regenerative signal of the 2nd demodulator circuit 52 is usually chosen and the 1st demodulator circuit 51 detects playback data, it consists of this example after it so that the regenerative signal of the 1st demodulator circuit 51 may be chosen and the read/write control circuit 7 may be supplied.

[0024] Therefore, a control circuit 53 generates the selection-control signal 65 over a selector circuit 54 by making the 1st regenerative signal 64 and sending signal 66 of a demodulator circuit 51 into an input signal, and it is constituted so that a selector circuit 54 may be controlled. However, reverse, i.e., also constitute so that the regenerative signal of the 2nd demodulator circuit 52 may be chosen after it and the read/write control circuit 7 may be supplied, can be described above, if the regenerative signal of the 1st demodulator circuit 51 is usually chosen and the 2nd demodulator circuit 52 detects playback data.

[0025] the receiving regenerative signal chosen by the above-mentioned approach is inputted into the read/write control circuit 7 -- having -- Type A (ISO14443-A) or Type B (ISO14443-B) -- data control is performed according to the protocol according to each type, and read/write (transmission and reception) of data to a memory circuit 8 is performed. The read/write control circuit 7 changes protocol control by inputting the selection signal of the type A signal identified by the control circuit 53 based on the signal from the 1st demodulator circuit 51, or a type B signal.

[0026] The above-mentioned modulation circuit 6 modulates a sending signal according to the modulation technique to which either the ASK modulation or 10%ASK modulation was fixed 100%, and drives a coil 2.

[0027] In addition, although the above-mentioned example explained the case where the circuit with a built-in noncontact IC card was formed as a semiconductor integrated circuit on one semiconductor chip, this invention is not limited to this, may form a rectifier circuit·3 and a power circuit 4 on one semiconductor chip in consideration of the property of a circuit using a bipolar transistor technique or Bi-CMOS technology, and may form the remaining circuit on another semiconductor chip using a CMOS technology. furthermore, a rectifier circuit 3 and a power circuit 4 -- an one semiconductor chip top -- moreover, a memory circuit 8 may be independently formed on one semiconductor chip, and the remaining circuit may be formed on one another semiconductor chip.

<Example 2 of operation gestalt> drawing 5 is drawing showing the 2nd example of the circuit with a built-in noncontact IC card concerning this invention.

[0028] Drawing 5 is the example which transposed the read/write control circuit 7 and memory circuit 8 in an example of drawing 4 to the one-chip microcomputer (an one chip microcomputer is called hereafter) 55. Generally, the one chip microcomputer is designed so that it may operate synchronizing with a clock, and from the exterior, the clock of constant frequency is always inputted and usually operates. However, especially, in ISO14443-A (1005ASK), since the signal received from a coil 2 is lost to the time amount corresponding to data "0" of this invention (the amplitude of a carrier signal is set to "0"), the clock signal reproduced from an input signal will be interrupted. Therefore, using a clock signal etc., when dynamic logic actuation of the precharge inside a microcomputer, refresh, etc. is performed, there is a possibility that actuation may no longer be guaranteed. Then, the one chip microcomputer 55 in the example of drawing 5 consists of circuits of a static logic method instead of the circuit of a dynamic logic method.

[0029] In this 2nd example, the regenerative signal detected in the 1st demodulator circuit 51 and 2nd demodulator circuit 52 is inputted into the back one chip microcomputer 55 chosen in the selector circuit 54, and protocol control and lead to an internal memory, light control, etc. are performed by the one chip microcomputer 55. Control of a selector circuit 54 is the same as the 1st example (drawing 4). Also in this example, about circuits other than one chip microcomputer 55, they may be summarized, you may constitute as one semiconductor integrated circuit, a rectifier circuit 3 and a power circuit 4 may be formed on one semiconductor chip, and the remaining circuit may be formed on one another semiconductor chip.

[0030] Drawing 6 is drawing explaining the actuation in the case of processing the signal of Type A (ISO14443-A), and drawing 7 is drawing explaining the actuation in the case of processing the signal of Type B (ISO14443-B).

[0031] In Type A of drawing 6 (ISO14443-A), data 61 are inputted into a coil as a modulating signal like the signal 62 modulated according to the ASK (amplitude modulation) method 100% by the reader writer equipment outside drawing. Binarization

of this input signal is carried out by the binarization circuit in the 1st demodulator circuit 51, a signal 63 is generated, and a regenerative signal 64 is acquired by performing filtering etc. This regenerative signal is chosen in a selector circuit 54, and is inputted into the read/write control circuit 7 or an one chip microcomputer 55.

[0032] On the other hand, if the control signal 65 of a selector circuit 54 is set high-level and the sending signal (response) 66 from a card to a reader writer is published by having detected the regenerative signal 64, it will be reset by the low level. While the control signal 65 of the above-mentioned selector is set, it operates in a selector circuit 54 so that the regenerative signal from the 1st demodulator circuit 51 may be chosen and the read/write control circuit 7 or an one chip microcomputer 55 may be supplied.

[0033] Drawing 7 is drawing showing the actuation in the case of processing the signal of Type B (ISO14443-B), and data 61 are inputted into a coil as a modulating signal like the signal 72 modulated according to the ASK (amplitude modulation) method 10%. Then, in the 2nd demodulator circuit 52, the data regenerative signal 74 which amplified and shaped in waveform the signal 73 and it which were detected by the detector circuit is generated. Moreover, a clock signal 75 is generated in the binarization circuit in a demodulator circuit 52. Furthermore, when the modulating signal of an ASK (amplitude modulation) method is inputted 10%, since the part in which a clock does not exist as a binarization signal is not detected, the regenerative signal shown with a broken line is not generated by the regenerative signal 64 like drawing 7 (F) in the 1st demodulator circuit 51. therefore, as shown in drawing 7 (G), a select signal 64 is not set high-level and chose the regenerative signal of the 2nd demodulator circuit 52 -- a condition -- **

[0034] As mentioned above, the reception of the signal of both Type A of a contiguity mold noncontact IC card (ISO14443-A) and the type B (ISO14443-B) can be carried out by choosing an ASK signal and 10%ASK signal 100% with the signal to which it restored.

[0035] In addition, in the above-mentioned example, the 1st demodulator circuit 51 which restores to the modulating signal of an ASK modulation technique 100% generates the binarization signal 63 as shown in this drawing (C) from the modulating signal 62 of drawing 6 (B), and it needs a binarization circuit in order to acquire a regenerative signal 64 like drawing 6 (D) by letting this binarization signal pass for a filter circuit etc.

[0036] Since the 2nd demodulator circuit 52 which restores to the signal of an ASK modulation technique 10% on the other hand reproduces data using the detector circuit which detects a modulating signal 72, for playback of data, its binarization circuit is unnecessary. However, a binarization circuit is separately needed in order to extract the clock signal 75 for the synchronization of a circuit from an input signal. Then, in the above-mentioned example, the binarization circuit is established in the

2nd demodulator circuit 52 which restores to the signal of an ASK modulation technique 10%, and also when this binarization circuit is omitted and the signal of an ASK modulation technique is received 10%, you may constitute so that a clock may be obtained using the binarization circuit established in the 1st demodulator circuit 51.

[0037] Although invention made by this invention person above was concretely explained based on the example, it cannot be overemphasized that it can change variously in the range which this invention is not limited to the above-mentioned example, and does not deviate from the summary. For example, although the above-mentioned example explained the combination card which can identify the signal of 100%ASK modulation technique, and two kinds of signals of the signal of 10%ASK modulation technique with one IC card, and can be processed, a modulation technique is not limited to an ASK modulation (amplitude modulation), and also when developing the IC card which can respond to other two or more modulation techniques, it can be applied.

[0038]

[Effect of the Invention] It will be as follows if the effectiveness acquired by the typical thing among invention indicated in this application is explained briefly.

[0039] Since it becomes possible to identify and choose two kinds of signals received with one coil according to this invention, the reception of the signal of both Type A of a contiguity mold noncontact IC card (ISO14443-A) and the type B (ISO14443-B) can be carried out, and the integrated card (combination card) of type A and Type B can be realized with an easy configuration.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The outline block diagram showing the outline configuration of the circuit built in the noncontact IC card of this invention.

[Drawing 2] IC card general drawing showing the outline configuration of the whole noncontact IC card of this invention.

[Drawing 3] The block block diagram showing the example of a configuration of the circuit built in a common noncontact IC card.

[Drawing 4] The block block diagram showing the 1st example of the circuit built in the noncontact IC card concerning this invention.

[Drawing 5] The block block diagram showing the 2nd example of the circuit built in the noncontact IC card concerning this invention.

[Drawing 6] The wave form chart explaining the actuation in the case of processing the signal of Type A (ISO14443-A) in the noncontact IC card of an example.

[Drawing 7] The wave form chart explaining the actuation in the case of processing

the signal of Type B (ISO14443-B) in the noncontact IC card of an example.

[Description of Notations]

1 Circuit with a Built-in Noncontact IC Card (LSI)

2 Coil

3 Rectifier Circuit

4 Power Circuit

5 Demodulator Circuit

6 Modulation Circuit

7 Read/write Control Circuit

8 Memory Circuit

51 1st Demodulator Circuit

52 2nd Demodulator Circuit

53 Control Circuit

54 Selector Circuit

55 One Chip Microcomputer LSI

61 Data

62 100%ASK Modulating Signal

63 Binarization Signal

64 Regenerative Signal

65 Select Signal

66 Response Signal

72 10%ASK Modulating Signal

73 Detection Signal

74 Data Regenerative Signal

75 Clock Signal (Binarization Signal)

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two. The noncontact IC card characterized by operating so that the output of the recovery means of either the recovery means of the above 1st or the 2nd recovery means may be chosen.

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[Claim 4] The read/write control means which carries out read/write of the data between the above-mentioned nonvolatile memory and this memory is a noncontact IC card according to claim 1 characterized by being constituted by the semiconductor-integrated-circuit-ized one-chip microcomputer.

[Claim 5] The above-mentioned one-chip microcomputer is a noncontact IC card according to claim 4 characterized by being constituted by the circuit of a static logic method.

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actuation of a consecutive control circuit, for example, the read/write control circuit of EEPROM, and a microcomputer.

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[0013]

[Means for Solving the Problem] It will be as follows if the outline of a typical thing is explained among invention indicated in this application.

[0014] In order to solve said technical problem, this invention establishes the 1st recovery means which reproduces data from an ASK signal type A(ISO14443-A) 100% about the signal received with the coil as an electromagnetic-coupling means, the 2nd recovery means which reproduces the data of an ASK signal type B(ISO14443-B) 10% from the signal received with the coil, and the selector means for choosing each regenerative signal. Moreover, in order to control this selector means, the control means for generating a selection-control signal is established by considering the 1st regenerative signal and sending signal of a recovery means as an input. And it constitutes so that either the regenerative signal (input signal from a reader writer to a card) of the 1st recovery means or the regenerative signal of the 2nd recovery means may be chosen with the above-mentioned selector means. Moreover, after it, when the selector means was controlled by the control means, the regenerative signal of the 2nd recovery means (or 1st recovery means) was usually chosen and the 1st recovery means detected playback data, it constituted so that the regenerative signal of the 1st recovery means (or 2nd recovery means) might be chosen.

[0015] Furthermore, the above-mentioned control means will control a selector means to choose the regenerative signal of the 2nd recovery means (or 1st recovery means), if the sending signal from a card to a reader writer occurs. And according to the input signal chosen as mentioned above, the read/write control means was made to perform a lead and light of data to nonvolatile memory, such as EEPROM.

[0016] According to the above-mentioned means, the circuit built in the noncontact IC card or it which can carry out reception also of which of ISO14443-A and ISO14443-B is realizable.

[0017] Moreover, it was made for the recovery means of the above 1st to make a clock signal generate based on the output of the above-mentioned binarization circuit including the binarization circuit which carries out binarization of the input signal at the time of reception [which / of 100%ASK modulating signal or 10%ASK modulating signal]. The circuit which reproduces a clock from an ASK modulating signal or 10%ASK modulating signal 100% can be shared by this, a clock generation circuit

becomes unnecessary at the 2nd recovery means, and simplification of a circuit is attained.

[0018] Furthermore, the above-mentioned read/write control means and nonvolatile memory are constituted from an one-chip microcomputer (LSI) etc., and you may make it control using software. And it is desirable to use what was constituted from a circuit of the static logic method instead of the dynamic logic method which the one-chip microcomputer precharges the predetermined node in a circuit beforehand, decides the potential of a node with an input signal, and opts for fanout which passes a current on the current pass according to an input signal, and determines fanout as it in this case. Since the clock signal reproduced from an input signal may be interrupted when Type A (ISO14443-A), i.e., the signal of 100%ASK modulation technique, is received, when the circuit of a dynamic logic method is used, it is because there is a possibility that actuation may not be guaranteed.

[0019]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail.

The block diagram, drawing 1 , and drawing 2 which show the 1st example of the circuit with a built-in noncontact IC card which <example 1 of operation gestalt> drawing 4 requires for this invention are drawing showing the configuration of the IC card which used the circuit with a built-in noncontact IC card of this invention.

[0020] It is carried or built and the circuit 1 with a built-in noncontact IC card as shown in drawing 1 , and the coil 2 as an electromagnetic-coupling means become the card with which the IC card of this example consists of insulating substrates, such as plastics or a ceramic. Although especially the coil 2 is not restricted, as shown in drawing 2 , it is constituted by the printed circuit formed on the substrate 10 at the curled form. Although especially the circuit 1 with a built-in card is not restricted, it is constituted as a semiconductor integrated circuit on one semi-conductor substrate like a single crystal silicon chip.

[0021] The conventional general circuit 1 with a built-in noncontact IC card The rectifier circuit 3 which is connected to a coil 2, rectifies a receiving AC signal, and is changed into direct current voltage as shown in drawing 3 , The power circuit 4 which generates the supply voltage VDD required for the drive of the circuit in IC based on the direct current voltage changed by this rectifier circuit 3, The demodulator circuit 5 which extracts receipt information contained in the AC signal supplied from the outside through the above-mentioned coil 2 (recovery), The modulation circuit 6 which forms the AC signal containing transmit information (modulation), and drives the above-mentioned coil 2, The nonvolatile memory 8 in which write-in elimination on an electric target like EEPROM is possible, By said demodulator circuit 5 Protocol control of transmission and reception between external reader writers in the processing list of outputting the transmit information which wrote in data or was read

from nonvolatile memory 8 into said nonvolatile memory 8 based on the receipt information to which it restored to said modulation circuit 6 It is constituted by the read/write control circuit 7 to perform.

[0022] The AC signal received with the above-mentioned coil 2 is inputted into a demodulator circuit 5, recovers this from the signal by which the ASK modulation (amplitude modulation) was carried out, and reproduces a data signal. The reproduced data are written in the EEPROM memory circuit 8 by the read/write control circuit 7 which performs transceiver protocol control in the read/write control list of memory. On the other hand, the transmit data from a card to a reader writer is read from a memory circuit 8 by the read/write control circuit 7, by the modulation circuit 6, performs LSK (load modulation) to a coil signal, and transmits data.

[0023] As shown in drawing 4 , in the 1st example of this invention a demodulator circuit It consists of the 2nd demodulator circuit 52 for reproducing 10%ASK signal of the 1st demodulator circuit 51 for reproducing 100%ASK signal of ISO14443-A from the signal received with the coil 2, and ISO14443-B. Either is chosen by the selector circuit 54 and the signal to which it restored by the 1st demodulator circuit 51 or 2nd demodulator circuit 52 is inputted into the read/write control circuit 7. Said selector circuit 54 is controlled by the control circuit 53. If the regenerative signal of the 2nd demodulator circuit 52 is usually chosen and the 1st demodulator circuit 51 detects playback data, it consists of this example after it so that the regenerative signal of the 1st demodulator circuit 51 may be chosen and the read/write control circuit 7 may be supplied.

[0024] Therefore, a control circuit 53 generates the selection-control signal 65 over a selector circuit 54 by making the 1st regenerative signal 64 and sending signal 66 of a demodulator circuit 51 into an input signal, and it is constituted so that a selector circuit 54 may be controlled. However, reverse, i.e., also constitute so that the regenerative signal of the 2nd demodulator circuit 52 may be chosen after it and the read/write control circuit 7 may be supplied, can be described above, if the regenerative signal of the 1st demodulator circuit 51 is usually chosen and the 2nd demodulator circuit 52 detects playback data.

[0025] the receiving regenerative signal chosen by the above-mentioned approach is inputted into the read/write control circuit 7 -- having -- Type A (ISO14443-A) or Type B (ISO14443-B) -- data control is performed according to the protocol according to each type, and read/write (transmission and reception) of data to a memory circuit 8 is performed. The read/write control circuit 7 changes protocol control by inputting the selection signal of the type A signal identified by the control circuit 53 based on the signal from the 1st demodulator circuit 51, or a type B signal.

[0026] The above-mentioned modulation circuit 6 modulates a sending signal according to the modulation technique to which either the ASK modulation or 10%ASK modulation was fixed 100%, and drives a coil 2.

[0027] In addition, although the above-mentioned example explained the case where the circuit with a built-in noncontact IC card was formed as a semiconductor integrated circuit on one semiconductor chip, this invention is not limited to this, may form a rectifier circuit 3 and a power circuit 4 on one semiconductor chip in consideration of the property of a circuit using a bipolar transistor technique or Bi-CMOS technology, and may form the remaining circuit on another semiconductor chip using a CMOS technology. furthermore, a rectifier circuit 3 and a power circuit 4 -- an one semiconductor chip top -- moreover, a memory circuit 8 may be independently formed on one semiconductor chip, and the remaining circuit may be formed on one another semiconductor chip.

<Example 2 of operation gestalt> drawing 5 is drawing showing the 2nd example of the circuit with a built-in noncontact IC card concerning this invention.

[0028] Drawing 5 is the example which transposed the read/write control circuit 7 and memory circuit 8 in an example of drawing 4 to the one-chip microcomputer (an one chip microcomputer is called hereafter) 55. Generally, the one chip microcomputer is designed so that it may operate synchronizing with a clock, and from the exterior, the clock of constant frequency is always inputted and usually operates. However, especially, in ISO14443-A (1005ASK), since the signal received from a coil 2 is lost to the time amount corresponding to data "0" of this invention (the amplitude of a carrier signal is set to "0"), the clock signal reproduced from an input signal will be interrupted. Therefore, using a clock signal etc., when dynamic logic actuation of the precharge inside a microcomputer, refresh, etc. is performed, there is a possibility that actuation may no longer be guaranteed. Then, the one chip microcomputer 55 in the example of drawing 5 consists of circuits of a static logic method instead of the circuit of a dynamic logic method.

[0029] In this 2nd example, the regenerative signal detected in the 1st demodulator circuit 51 and 2nd demodulator circuit 52 is inputted into the back one chip microcomputer 55 chosen in the selector circuit 54, and protocol control and lead to an internal memory, light control, etc. are performed by the one chip microcomputer 55. Control of a selector circuit 54 is the same as the 1st example (drawing 4). Also. in this example, about circuits other than one chip microcomputer 55, they may be summarized, you may constitute as one semiconductor integrated circuit, a rectifier circuit 3 and a power circuit 4 may be formed on one semiconductor chip, and the remaining circuit may be formed on one another semiconductor chip.

[0030] Drawing 6 is drawing explaining the actuation in the case of processing the signal of Type A (ISO14443-A), and drawing 7 is drawing explaining the actuation in the case of processing the signal of Type B (ISO14443-B).

[0031] In Type A of drawing 6 (ISO14443-A), data 61 are inputted into a coil as a modulating signal like the signal 62 modulated according to the ASK (amplitude modulation) method 100% by the reader writer equipment outside drawing. Binarization

of this input signal is carried out by the binarization circuit in the 1st demodulator circuit 51, a signal 63 is generated, and a regenerative signal 64 is acquired by performing filtering etc. This regenerative signal is chosen in a selector circuit 54, and is inputted into the read/write control circuit 7 or an one chip microcomputer 55.

[0032] On the other hand, if the control signal 65 of a selector circuit 54 is set high-level and the sending signal (response) 66 from a card to a reader writer is published by having detected the regenerative signal 64, it will be reset by the low level. While the control signal 65 of the above-mentioned selector is set, it operates in a selector circuit 54 so that the regenerative signal from the 1st demodulator circuit 51 may be chosen and the read/write control circuit 7 or an one chip microcomputer 55 may be supplied.

[0033] Drawing 7 is drawing showing the actuation in the case of processing the signal of Type B (ISO14443-B), and data 61 are inputted into a coil as a modulating signal like the signal 72 modulated according to the ASK (amplitude modulation) method 10%. Then, in the 2nd demodulator circuit 52, the data regenerative signal 74 which amplified and shaped in waveform the signal 73 and it which were detected by the detector circuit is generated. Moreover, a clock signal 75 is generated in the binarization circuit in a demodulator circuit 52. Furthermore, when the modulating signal of an ASK (amplitude modulation) method is inputted 10%, since the part in which a clock does not exist as a binarization signal is not detected, the regenerative signal shown with a broken line is not generated by the regenerative signal 64 like drawing 7 (F) in the 1st demodulator circuit 51. therefore, as shown in drawing 7 (G), a select signal 64 is not set high-level and chose the regenerative signal of the 2nd demodulator circuit 52 -- a condition -- **

[0034] As mentioned above, the reception of the signal of both Type A of a contiguity mold noncontact IC card (ISO14443-A) and the type B (ISO14443-B) can be carried out by choosing an ASK signal and 10%ASK signal 100% with the signal to which it restored.

[0035] In addition, in the above-mentioned example, the 1st demodulator circuit 51 which restores to the modulating signal of an ASK modulation technique 100% generates the binarization signal 63 as shown in this drawing (C) from the modulating signal 62 of drawing 6 (B), and it needs a binarization circuit in order to acquire a regenerative signal 64 like drawing 6 (D) by letting this binarization signal pass for a filter circuit etc.

[0036] Since the 2nd demodulator circuit 52 which restores to the signal of an ASK modulation technique 10% on the other hand reproduces data using the detector circuit which detects a modulating signal 72, for playback of data, its binarization circuit is unnecessary. However, a binarization circuit is separately needed in order to extract the clock signal 75 for the synchronization of a circuit from an input signal. Then, in the above-mentioned example, the binarization circuit is established in the

2nd demodulator circuit 52 which restores to the signal of an ASK modulation technique 10%, and also when this binarization circuit is omitted and the signal of an ASK modulation technique is received 10%, you may constitute so that a clock may be obtained using the binarization circuit established in the 1st demodulator circuit 51.

[0037] Although invention made by this invention person above was concretely explained based on the example, it cannot be overemphasized that it can change variously in the range which this invention is not limited to the above-mentioned example, and does not deviate from the summary. For example, although the above-mentioned example explained the combination card which can identify the signal of 100%ASK modulation technique, and two kinds of signals of the signal of 10%ASK modulation technique with one IC card, and can be processed, a modulation technique is not limited to an ASK modulation (amplitude modulation), and also when developing the IC card which can respond to other two or more modulation techniques, it can be applied.

[0038]

[Effect of the Invention] It will be as follows if the effectiveness acquired by the typical thing among invention indicated in this application is explained briefly.

[0039] Since it becomes possible to identify and choose two kinds of signals received with one coil according to this invention, the reception of the signal of both Type A of a contiguity mold noncontact IC card (ISO14443-A) and the type B (ISO14443-B) can be carried out, and the integrated card (combination card) of type A and Type B can be realized with an easy configuration.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The outline block diagram showing the outline configuration of the circuit built in the noncontact IC card of this invention.

[Drawing 2] IC card general drawing showing the outline configuration of the whole noncontact IC card of this invention.

[Drawing 3] The block block diagram showing the example of a configuration of the circuit built in a common noncontact IC card.

[Drawing 4] The block block diagram showing the 1st example of the circuit built in the noncontact IC card concerning this invention.

[Drawing 5] The block block diagram showing the 2nd example of the circuit built in the noncontact IC card concerning this invention.

[Drawing 6] The wave form chart explaining the actuation in the case of processing the signal of Type A (ISO14443-A) in the noncontact IC card of an example.

[Drawing 7] The wave form chart explaining the actuation in the case of processing

the signal of Type B (ISO14443-B) in the noncontact IC card of an example.

[Description of Notations]

1 Circuit with a Built-in Noncontact IC Card (LSI)

2 Coil

3 Rectifier Circuit

4 Power Circuit

5 Demodulator Circuit

6 Modulation Circuit

7 Read/write Control Circuit

8 Memory Circuit

51 1st Demodulator Circuit

52 2nd Demodulator Circuit

53 Control Circuit

54 Selector Circuit

55 One Chip Microcomputer LSI

61 Data

62 100%ASK Modulating Signal

63 Binarization Signal

64 Regenerative Signal

65 Select Signal

66 Response Signal

72 10%ASK Modulating Signal

73 Detection Signal

74 Data Regenerative Signal

75 Clock Signal (Binarization Signal)

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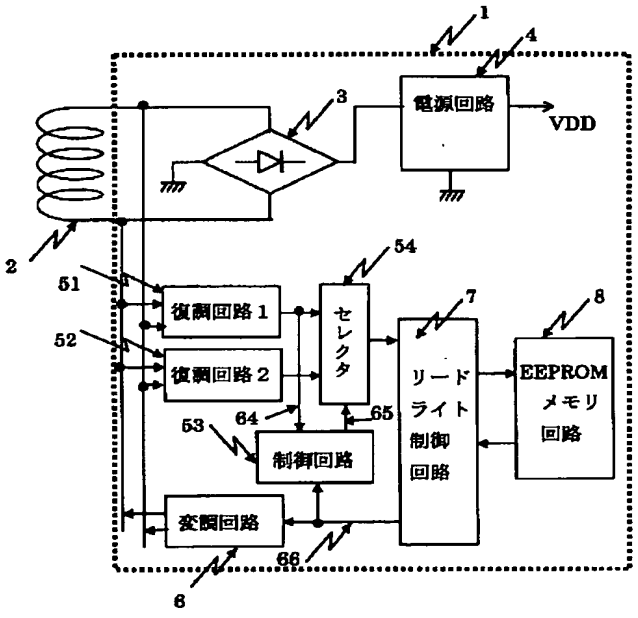
最終頁に続く

(54)【発明の名称】　非接触ＩＣカード

(57)【要約】
【課題】　IS014443-AとIS014443-Bのいずれの規格の方式で変調された信号でも受信処理できる非接触ＩＣカードおよびそれを実現するための半導体集積回路を提供する。
【解決手段】　コイルで受信した信号についてタイプＡ(IS014443-A)１００％ＡＳＫ信号からデータを再生する第１の復調回路（５１）と、コイルで受信した信号からタイプＢ(IS014443-Ｂ)１０％ＡＳＫ信号のデータを再生する第２の復調回路（５２）と、それぞれの再生信号を選択するためのセレクタ回路（５４）と、選択制御信号を発生させるための制御回路（５３）とを設けるようにした。



【特許請求の範囲】
【請求項１】　交流信号を送受信するための電磁結合手段と、該電磁結合手段に接続され交流信号を整流して所望の直流電源電圧を発生する電源手段と、不揮発性メモリと、該メモリとの間でデータをリードライトするリードライト制御手段と、上記電磁結合手段に接続されて受信交流信号から受信データを抽出するための第１の復調手段および第２の復調手段の少なくとも２種類の復調手段と、データを送信するための変調手段と、上記少なくとも２種類の復調手段の出力を選択するためのセレクタ手段と、該セレクタを制御するための制御手段とを備え、上記第１の復調手段および第２の復調手段の両方または片方の復調信号に基づいて上記セレクタ手段を制御し、上記第１の復調手段あるいは第２の復調手段のいずれか一方の復調手段の出力を選択するように動作することを特徴とする非接触ＩＣカード。
【請求項２】　上記第１の復調手段は１００％ＡＳＫ変調（振幅変調）信号を復調するための回路であり、第２の復調手段は１０％ＡＳＫ変調信号を復調するための回路であることを特徴とする請求項1記載の非接触ＩＣカード。
【請求項３】　上記第１の復調手段は、受信信号を二値化する二値化回路を含み、１００％ＡＳＫ変調信号または１０％ＡＳＫ変調信号のいずれの受信時においても上記二値化回路の出力に基づいてクロック信号を生成することを特徴とする請求項２記載の非接触ＩＣカード。
【請求項４】　上記不揮発性メモリと、該メモリとの間でデータをリードライトするリードライト制御手段は、半導体集積回路化されたワンチップマイクロコンピュータにより構成されていることを特徴とする請求項1記載の非接触ＩＣカード。
【請求項５】　上記ワンチップマイクロコンピュータは、スタティック論理方式の回路により構成されていることを特徴とする請求項４記載の非接触ＩＣカード。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、ＩＣカードさらにはＩＣカードに内蔵される半導体集積回路チップで構成される回路に係わり、特に非接触方式で２種類以上の通信方式によるデータの送受信に対応可能な非接触ＩＣカードに内蔵される回路に利用して好適な技術に関する。
【０００２】
【従来の技術】近年、磁気カードに代わる情報記憶媒体として、ＣＰＵ（マイクロプロセッサ）等のＩＣを内蔵したＩＣカードが注目を集めている。ＩＣカードには信号の伝送方式により、接点を用いてリーダライタ装置から電力およびクロック信号と情報信号を受信し、コマンドを処理する接触方式のＩＣカードと、リーダライタ装置のコイルから発生される電波(電磁波）を、ＩＣカード側のコイルで受信し、電力およびクロック、送受信信号を生成して、リーダライタ装置より受信したコマンドを処理する非接触方式のＩＣカード（以下非接触ＩＣカードという）の２方式がある。
【０００３】このうち非接触ＩＣカードは、通信距離や通信周波数によってＩＳＯ規格が制定されており、密着型(ISO10536)、近接型(ISO14443)の２種類がある。さらに近接型非接触ＩＣカードには、データの変調方式によって、周波数１３．５６MHzのキャリア信号が存在する状態でデータ“１”を表わし、キャリア信号のない状態でデータ“０”を表わす１００％ＡＳＫ変調（ＡＳＫ：振幅変調）方式を採用しているISO14443-Aと、データ“１”を表わす振幅のキャリア信号に対し９０％の振幅の信号でデータ“０”を表わす１０％ＡＳＫ変調方式を採用しているISO14443-Bの２種類がある。
【０００４】ISO14443-A変調方式は、一般にＣＰＵを持たないハードウエアロジックで構成された制御回路を持つ非接触ＩＣカードに利用される方式であり、一般に、ISO14443-AはシンプルなプロトコルをもつＩＣカード用として、例えばＩＤカード（個人識別カード）やプリペードカードなどに利用されることが多い。一方、ISO14443-Bタイプは、ＣＰＵを内蔵した非接触ＩＣカードで利用される方式であり、ISO14443-Bは複雑なプロトコル（例えばISO7816-T1など）をもつ銀行用のキャッシュカードやクレジットカードなどに利用されることが多い。
【０００５】また、近年、非接触ＩＣカードの普及に伴い、各種仕様のカードを統合したコンビネーションカードなるものが提案されている。
【０００６】
【発明が解決しようとする課題】コンビネーションカードとしては、接触型ＩＣカードと非接触型ＩＣカードのコンビネーションが現在は主流であるが、今後はいろいろなタイプのＩＣカードを統合したコンビネーションカードの出現が考えられる。
【０００７】本発明者らは、ISO14443-AタイプとISO14443-Bタイプを統合したコンビネーションカードを構成する方法について検討した。
【０００８】上述したように、リーダライタからカードへのデータの変調方式として、ISO14443-Aは１００％ＡＳＫ変調方式を使用し、ISO14443-Bは１０％ＡＳＫ変調方式を使用している。
【０００９】上記２種類の変調方式を一枚のＩＣカード上で実現するための課題としては、変調方式の異なる信号の両方を受信するために、それぞれの復調回路が必要なことはいうまでもないが、メモリを共有して使用するＩＣカードシステムにおいては、どちらの変調信号を受信したかを識別しなければ、後続のメモリリードライト制御回路の動作やマイコンの動作ができないという問題がある。
【００１０】従って、カードがリーダライタに挿入された時点でどちらの変調方式の信号を受信したかを識別し

て、後続の制御回路例えばＥＥＰＲＯＭのリードライト制御回路やマイコンの動作を制御する必要がある。

【００１１】本発明の目的は、ISO14443-AとISO14443-Bのいずれの規格の方式で変調された信号でも受信処理できる非接触ＩＣカードおよびそれに内蔵される回路を提供することにある。

【００１２】この発明の前記ならびにそのほかの目的と新規な特徴については、本明細書の記述及び添付図面から明らかになるであろう。

【００１３】

【課題を解決するための手段】本願において開示される発明のうち代表的なものの概要を説明すれば、下記のとおりである。

【００１４】前記課題を解決するために本発明は、電磁結合手段としてのコイルで受信した信号についてタイプＡ(ISO14443-A)１００％ＡＳＫ信号からデータを再生する第１の復調手段と、コイルで受信した信号からタイプＢ(ISO14443-Ｂ)１０％ＡＳＫ信号のデータを再生する第２の復調手段と、それぞれの再生信号を選択するためのセレクタ手段とを設ける。また、このセレクタ手段を制御するために、第１の復調手段の再生信号と送信信号とを入力として、選択制御信号を発生させるための制御手段を設ける。そして、上記セレクタ手段によって第１の復調手段の再生信号（リーダライタからカードへの受信信号）または第２の復調手段の再生信号のいずれかを選択するように構成する。また、セレクタ手段は、制御手段で制御され、通常は第２の復調手段（または第１の復調手段）の再生信号を選択しており、第１の復調手段が再生データを検出すると、それ以降は第１の復調手段（または第２の復調手段）の再生信号を選択するように構成した。

【００１５】さらに、上記制御手段は、カードからリーダライタへの送信信号が発生すると、第２の復調手段（または第１の復調手段）の再生信号を選択するようにセレクタ手段を制御する。そして、上記のようにして選択された受信信号に従って、リードライト制御手段は、ＥＥＰＲＯＭなどの不揮発性メモリに対してデータのリードやライトを行なうようにした。

【００１６】上記した手段によれば、ISO14443-AとISO14443-Bのどちらでも受信処理できる非接触ＩＣカードもしくはそれに内蔵される回路を実現することができる。

【００１７】また、上記第１の復調手段は、受信信号を二値化する二値化回路を含み、１００％ＡＳＫ変調信号または１０％ＡＳＫ変調信号のいずれの受信時においても上記二値化回路の出力に基づいてクロック信号を生成させるようにした。これにより、１００％ＡＳＫ変調信号または１０％ＡＳＫ変調信号からクロックを再生する回路を共用することができ、第２の復調手段にはクロック生成回路が不要になって回路の簡略化が可能になる。

【００１８】さらに、上記リードライト制御手段と不揮発性メモリとをワンチップマイクロコンピュータ（ＬＳＩ）などで構成しソフトウエアを用いて制御するようにしてもよい。しかもこの場合、ワンチップマイクロコンピュータは、予め回路内の所定のノードをプリチャージしておいて入力信号でノードの電位を確定して論理出力を決定するダイナミック論理方式でなく、入力信号に応じた電流パスに電流を流して論理出力を決定するスタティック論理方式の回路で構成したものを用いるのが望ましい。タイプＡ(ISO14443-A)すなわち１００％ＡＳＫ変調方式の信号を受信した場合には受信信号から再生されるクロック信号が中断することがあるため、ダイナミック論理方式の回路を用いると動作が保証されない恐れがあるためである。

【００１９】

【発明の実施の形態】以下、本発明の実施の形態について詳細に説明する。

＜実施形態例１＞図４は本発明に係る非接触ＩＣカード内蔵回路の第１の実施例を示すブロック図、図１および図２は、本発明の非接触ＩＣカード内蔵回路を用いたＩＣカードの構成を示す図である。

【００２０】この実施例のＩＣカードは、プラスチックあるいはセラミックなどの絶縁性の基板からなるカードに、図１に示すような非接触ＩＣカード内蔵回路１と電磁結合手段としてのコイル２とが搭載もしくは内蔵されてなる。コイル２は、特に制限されないが、図２に示すように、基板１０上に渦巻き状に形成されたプリント配線等により構成される。カード内蔵回路１は特に制限されないが、単結晶シリコンチップのような１個の半導体基板上に半導体集積回路として構成される。

【００２１】従来の一般的な非接触ＩＣカード内蔵回路１は、図３に示すように、コイル２に接続され受信交流信号を整流して直流電圧に変換する整流回路３と、該整流回路３により変換された直流電圧に基づいてＩＣ内の回路の駆動に必要な電源電圧ＶDDを発生する電源回路４と、上記コイル２を介して外部から供給される交流信号に含まれる受信情報を抽出（復調）する復調回路５と、送信情報を含む交流信号を形成（変調）して上記コイル２を駆動する変調回路６と、ＥＥＰＲＯＭのような電気的に書込み消去可能な不揮発性メモリ８と、前記復調回路５により復調された受信情報に基づいて前記不揮発性メモリ８内へデータを書き込んだり不揮発性メモリ８から読み出された送信情報を前記変調回路６へ出力するなどの処理並びに外部のリーダライタとの間の送受信のプロトコル制御を行なうリードライト制御回路７などにより構成されている。

【００２２】上記コイル２で受信した交流信号は、復調回路５に入力され、ＡＳＫ変調（振幅変調）された信号からこれを復調し、データ信号を再生する。再生されたデータは、メモリのリードライト制御並びに送受信プロトコル制御を行なうリードライト制御回路７によってＥ

ＥＰＲＯＭメモリ回路８へ書き込まれる。一方、カードからリーダライタへの送信データは、リードライト制御回路７によってメモリ回路８から読み出され、変調回路６によってコイル信号に対してLSK（負荷変調）を行い、データを送信する。

【００２３】本発明の第１の実施例においては、図４に示すように、復調回路が、コイル２によって受信された信号からIS014443-Aの１００％ＡＳＫ信号を再生するための第１の復調回路５１とIS014443-Bの１０％ＡＳＫ信号を再生するための第２の復調回路５２とからなり、第１の復調回路５１または第２の復調回路５２によって復調された信号はセレクタ回路５４によって、どちらか一方が選択され、リードライト制御回路７へ入力される。前記セレクタ回路５４は、制御回路５３によって制御される。この実施例では、通常は第２の復調回路５２の再生信号を選択しており、第１の復調回路５１が再生データを検出すると、それ以降は第１の復調回路５１の再生信号を選択してリードライト制御回路７へ供給するように構成されている。

【００２４】そのため、制御回路５３は、第１の復調回路５１の再生信号６４と送信信号６６とを入力信号として、セレクタ回路５４に対する選択制御信号６５を発生し、セレクタ回路５４を制御するように構成されている。ただし、上記とは逆、すなわち通常は第１の復調回路５１の再生信号を選択しており、第２の復調回路５２が再生データを検出すると、それ以降は第２の復調回路５２の再生信号を選択してリードライト制御回路７へ供給するように構成することも可能である。

【００２５】上記方法で選択された受信再生信号は、リードライト制御回路７に入力され、タイプＡ(IS014443-A)またはタイプＢ(IS014443-B)それぞれのタイプに応じたプロトコルに従ってデータ制御が行なわれ、メモリ回路８に対するデータのリードライト（送受信）が行なわれる。リードライト制御回路７は、第１の復調回路５１からの信号に基づいて制御回路５３により識別されたタイプＡ信号かタイプＢ信号かの選択信号が入力されることによって、プロトコル制御の切り替えを行なう。

【００２６】上記変調回路６は、１００％ＡＳＫ変調または１０％ＡＳＫ変調のいずれか一方の固定された変調方式に従って送信信号を変調してコイル２を駆動する。

【００２７】なお、上記実施例では、非接触ＩＣカード内蔵回路が１つの半導体チップ上に半導体集積回路として形成されている場合について説明したが、本発明はこれに限定されるものでなく、回路の特性を考慮して、例えば整流回路３と電源回路４をバイポーラトランジスタ技術あるいはＢｉ－ＣＭＯＳ技術を用いて１つの半導体チップ上に形成し、残りの回路をＣＭＯＳ技術を用いて別の半導体チップ上に形成しても良い。さらに、整流回路３と電源回路４とを１つの半導体チップ上に、またメモリ回路８を単独で１つの半導体チップ上に形成し、残りの回路を別の１つの半導体チップ上に形成しても良い。

＜実施形態例２＞図５は、本発明に係る非接触ＩＣカード内蔵回路の第２の実施例を示す図である。

【００２８】図５は、図４の実施例におけるリードライト制御回路７とメモリ回路８を、ワンチップマイクロコンピュータ（以下、ワンチップマイコンと称する）５５に置き換えた実施例である。一般にワンチップマイコンはクロックに同期して動作するように設計されており、通常は一定周波数のクロックが外部より常時入力されて動作する。ところが、本発明の特にIS014443-A(1005ＡＳＫ）の場合には、データ“０”に対応する時間にはコイル２から受信される信号がなくなる（キャリア信号の振幅が「０」になる）ため、受信信号から再生されるクロック信号が中断することになる。したがって、クロック信号などを用いて、マイコン内部のプリチャージやリフレッシュなどのダイナミック論理動作を行うと動作が保証されなくなるおそれがある。そこで、図５の実施例におけるワンチップマイコン５５は、ダイナミック論理方式の回路でなく、スタティック論理方式の回路で構成されている。

【００２９】この第２の実施例では、第１の復調回路５１および第２の復調回路５２で検出された再生信号は、セレクタ回路５４で選択された後ワンチップマイコン５５に入力され、ワンチップマイコン５５によってプロトコル制御および内部メモリへのリード、ライト制御などが行なわれる。セレクタ回路５４の制御は第１の実施例（図４）と同じである。この実施例においても、ワンチップマイコン５５以外の回路に関しては、それらをまとめて１つの半導体集積回路として構成しても良いし、整流回路３と電源回路４とを１つの半導体チップ上に形成し残りの回路を別の１つの半導体チップ上に形成しても良い。

【００３０】図６はタイプＡ(IS014443-A)の信号を処理する場合の動作を説明する図であり、図７はタイプＢ(IS014443-B)の信号を処理する場合の動作を説明する図である。

【００３１】図６のタイプＡ(IS014443-A)の場合、データ６１は図外のリーダライタ装置によって１００％ＡＳＫ（振幅変調）方式に従って変調された信号６２のような変調信号としてコイルに入力される。この入力信号は第１の復調回路５１内の二値化回路によって二値化されて信号６３が生成され、フィルタ処理などを行うことによって再生信号６４が得られる。この再生信号がセレクタ回路５４で選択され、リードライト制御回路７またはワンチップマイコン５５に入力される。

【００３２】一方、セレクタ回路５４の制御信号６５は、再生信号６４が検出されたことによってハイレベルにセットされ、カードからリーダライタへの送信信号（レスポンス）６６を発行するとロウレベルにリセット

される。上記セレクタの制御信号６５がセットされている間、セレクタ回路５４では第１の復調回路５１からの再生信号を選択してリードライト制御回路７またはワンチップマイコン５５に供給するように動作する。

【００３３】図７はタイプＢ(ISO14443-B)の信号を処理する場合の動作を示す図であり、データ６１は１０％ＡＳＫ（振幅変調）方式に従って変調された信号７２のような変調信号としてコイルに入力される。すると、第２の復調回路５２において、検波回路によって検波した信号７３とそれを増幅して波形整形したデータ再生信号７４とが生成される。また、復調回路５２内の二値化回路ではクロック信号７５が生成される。さらに、１０％ＡＳＫ（振幅変調）方式の変調信号が入力された場合、第１の復調回路５１では、二値化信号としてクロックの存在しない部分が検出されないため、図７（Ｆ）のように再生信号６４には破線で示す再生信号は生成されない。したがって、図７（Ｇ）に示すように、セレクト信号６４はハイレベルにセットされることがなく、第２の復調回路５２の再生信号を選択した状態なる。

【００３４】以上のように、復調された信号によって、１００％ＡＳＫ信号と１０％ＡＳＫ信号とを選択することで近接型非接触ＩＣカードのタイプＡ(ISO14443-A)とタイプＢ(ISO14443-B)の両方の信号を受信処理できる。

【００３５】なお、上記実施例において、１００％ＡＳＫ変調方式の変調信号を復調する第１の復調回路５１は、図６（Ｂ）の変調信号６２から同図（Ｃ）のような二値化信号６３を生成し、この二値化信号をフィルタ回路等を通すことで図６（Ｄ）のような再生信号６４を得るため二値化回路を必要とする。

【００３６】一方、１０％ＡＳＫ変調方式の信号を復調する第２の復調回路５２は、変調信号７２を検波する検波回路を用いてデータを再生するので、データの再生のためには二値化回路は不用である。ただし、受信信号から回路の同期のためのクロック信号７５を抽出するため別個に二値化回路が必要となる。そこで、上記実施例では１０％ＡＳＫ変調方式の信号を復調する第２の復調回路５２にも二値化回路を設けているが、この二値化回路を省略して、１０％ＡＳＫ変調方式の信号を受信している場合にも第１の復調回路５１に設けられている二値化回路を用いてクロックを得るように構成しても良い。

【００３７】以上本発明者によってなされた発明を実施例に基づき具体的に説明したが、本発明は上記実施例に限定されるものではなく、その要旨を逸脱しない範囲で種々変更可能であることはいうまでもない。例えば、上記実施例では、１００％ＡＳＫ変調方式の信号と１０％ＡＳＫ変調方式の信号の２種類の信号を１つのＩＣカードで識別して処理することができるコンビネーションカードについて説明したが、変調方式はＡＳＫ変調（振幅変調）に限定されるものでなく、他の２以上の変調方式に対応可能なＩＣカードを開発する場合にも適用することができる。

【００３８】

【発明の効果】本願において開示される発明のうち代表的なものによって得られる効果を簡単に説明すれば下記のとおりである。

【００３９】本発明によれば、１つのコイルで受信した２種類の信号を識別し選択することが可能になるため、近接型非接触ＩＣカードのタイプＡ(ISO14443-A)とタイプＢ(ISO14443-B)の両方の信号を受信処理でき、簡単な構成でタイプＡ・タイプＢの統合カード（コンビネーションカード）が実現できる。

【図面の簡単な説明】

【図１】本発明の非接触ＩＣカードに内蔵される回路の概略構成を示す概略構成図。

【図２】本発明の非接触ＩＣカード全体の概略構成を示すＩＣカード全体図。

【図３】一般的な非接触ＩＣカードに内蔵される回路の構成例を示すブロック構成図。

【図４】本発明に係る非接触ＩＣカードに内蔵される回路の第１の実施例を示すブロック構成図。

【図５】本発明に係る非接触ＩＣカードに内蔵される回路の第２の実施例を示すブロック構成図。

【図６】実施例の非接触ＩＣカードにおいてタイプＡ(ISO14443-A)の信号を処理する場合の動作を説明する波形図。

【図７】実施例の非接触ＩＣカードにおいてタイプＢ(ISO14443-B)の信号を処理する場合の動作を説明する波形図。

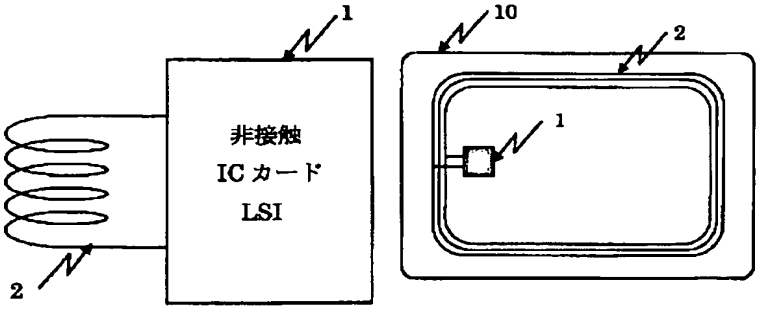
【符号の説明】

１　非接触ＩＣカード内蔵回路（ＬＳＩ）
２　コイル
３　整流回路
４　電源回路
５　復調回路
６　変調回路
７　リードライト制御回路
８　メモリ回路
５１　第１の復調回路
５２　第２の復調回路
５３　制御回路
５４　セレクタ回路
５５　ワンチップマイコンＬＳＩ
６１　データ
６２　１００％ＡＳＫ変調信号
６３　二値化信号
６４　再生信号
６５　セレクト信号
６６　レスポンス信号
７２　１０％ＡＳＫ変調信号
７３　検波信号

７４　データ再生信号

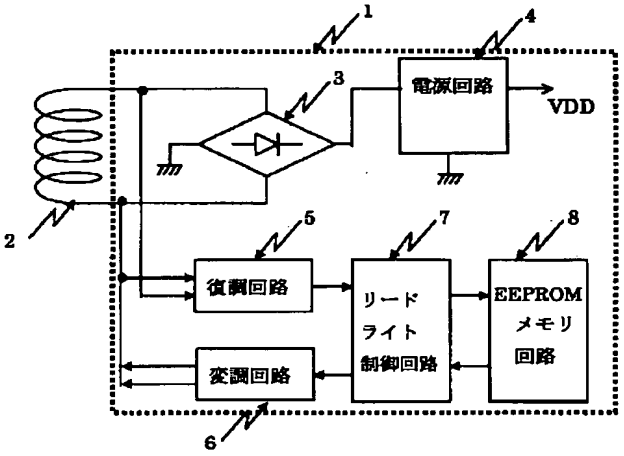
７５　クロック信号（二値化信号）

【図１】

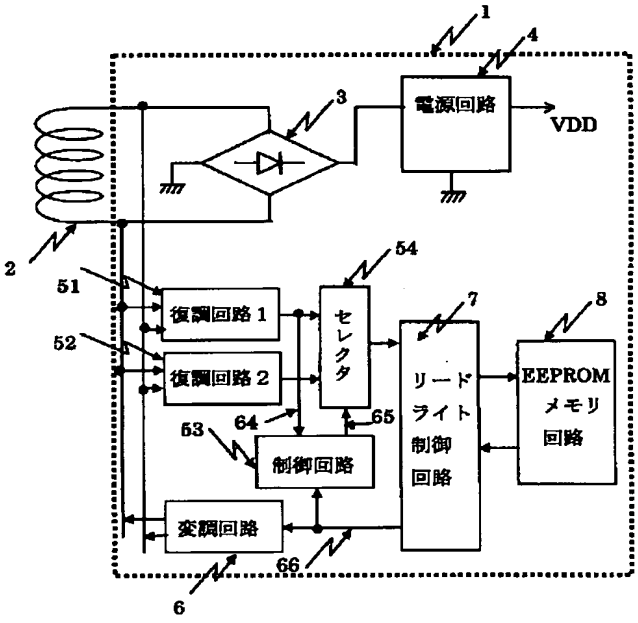


【図２】

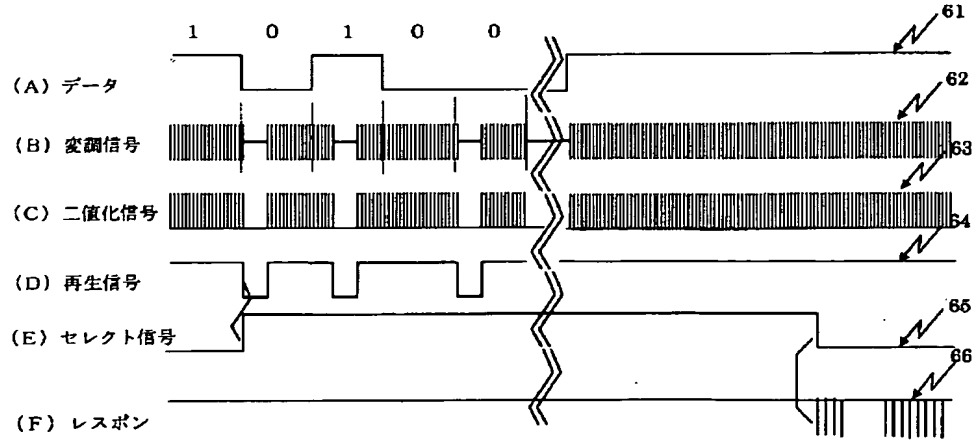
【図３】



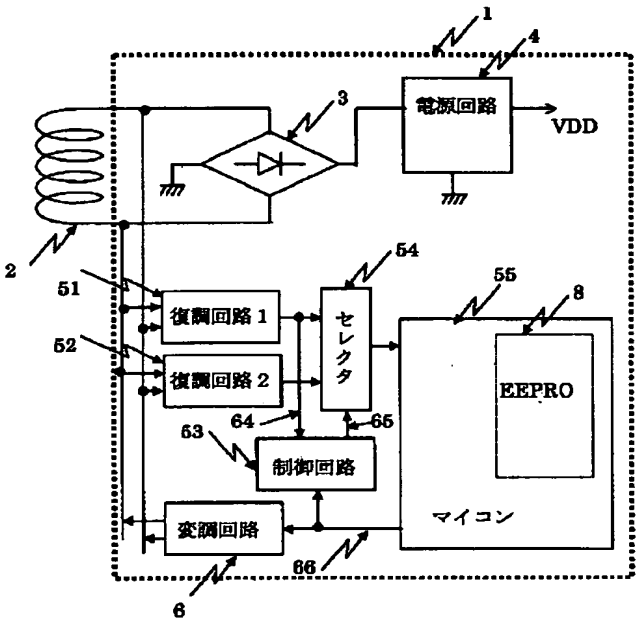
【図４】



【図６】



【図５】



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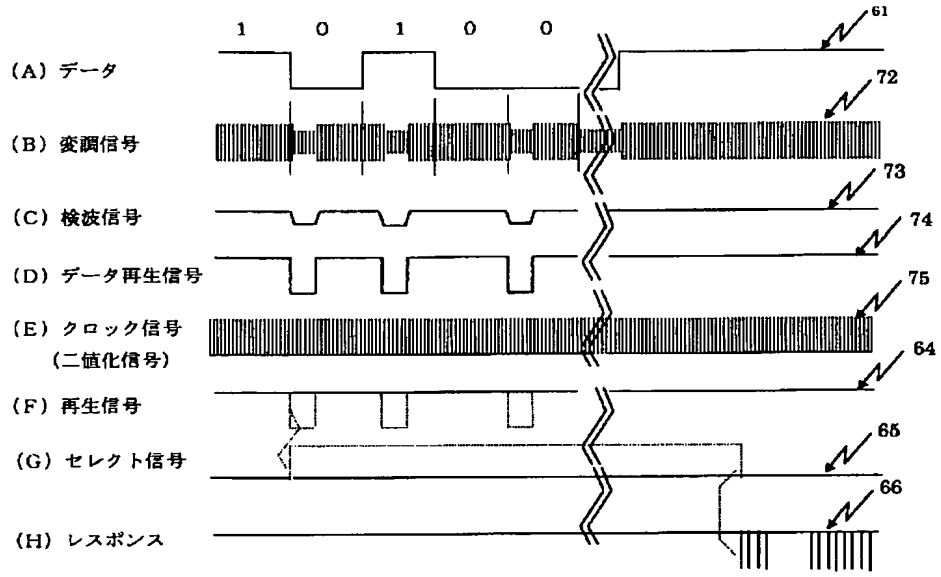

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